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ABSTRACT

Although reading is often viewed as a mysterious process, sufficient evidence is available to identify certain areas as promising for further research and others as unpromising. In applied research, the study of how reading programs are implemented in schools, including an examination of leadership roles, teacher attitudes, teacher training, and diagnosis, may yield crucial information on why certain schools succeed in teaching reading and others do not. In theory-based research, the study of visual word recognition, especially of the role of orthographic structure in this process, has already yielded interesting results. A fundamental understanding of word recognition is required, not only for its relation to early reading instruction, but also for its relation to comprehension. Since almost all approaches to reading instruction employ overt teaching of letter/sound correspondences, a thorough understanding of their acquisition and utilization merits a high priority in developmental research. Among the areas in which further research is not needed are instructional metholdologies, modified alphabets, and eye movements. (Author/GW)

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Theoretical Paper No. 63

READING ACQUISITION: THE OCCULT AND THE OBSCURE

by

Richard L. Venezky

Report from the Project on
Conditions of School Learning and Instructional Strategies

Wisconsin Research and Development
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ABSTRACT

Although reading is often viewed as a mysterious process, sufficient evidence is available to identify certain areas as promising for further research and others as unpromising. In applied research, the study of how reading programs are implemented in schools, including leadership roles, teacher attitudes, teacher training, and diagnosis may yield crucial information on why certain schools succeed in teaching reading and others do not. In theory based research, the study of visual word recognition and especially of the role of orthographic structure in this process has already yielded interesting results. A fundamental understanding of word recognition is required not only for its relation to early reading instruction, but also for its relation to comprehension. Among the areas in which further research is not needed are instructional methodologies, modified alphabets, and eye movements.

I

INTRODUCTION

The accouterments of reading--and especially the alphabet--have long been objects of mystery and misunderstanding. Socrates, who was usually quite sober and objective, claimed that the alphabet was invented by the Egyptian god Thoth but rejected by the reigning King of Egypt, out of fear that writing would impair man's memory and that people would read without understanding--a prophecy that perhaps has not been totally unrealized.

The earliest Germanic invaders of Briton brought with them an alphabet which was restricted to mystical applications. The term for the letters of this alphabet, rune, itself originates from the Old English word for mystery. At about the same time that Briton was being invaded by rune-carrying Germanics, St. Augustine was observing St. Ambrose read without moving his lips--an act which was, in Augustine's words, both surprising and perplexing.

The acquisition of reading has had no less a connection with the occult and obscure. The Greeks and Romans held that men of high rank who had lived evil lives would be forced to maintain themselves in the next world by teaching reading and writing. In this country as in England, the teaching of religion and reading were united for several hundred years. The Hornbook and the New England Primers, the earliest American reading systems, devoted more space to religious themes than to the basics of reading.

In literature, the mysteries of reading acquisition have also been perpetuated. Tarzan, as probably few remember, taught himself to read English at a time when his communicative repertoire was limited to basic snake, monkey, and elephant. This was possible, his creator tells us, because of the "active intelligence of a healthy mind endowed by inheritance with more than ordinary reasoning powers [Burroughs, 1914, p. 24]." (No doubts are expressed here about the relative potencies of nature and nurture.) Shakespeare presented a similar view in Much Ado About Nothing: "To be a well-favored man is the gift of fortune, but to write and read comes by nature."

Mayakovsky, the controversial poet of the Russian revolution, also laid claim to self-taught literacy:

> The human fledgling--
> barely out of the egg--
> grasps at a book,
> at quires of exercise paper.
> But I learned my alphabet
> from signboards,
> leafing through pages of iron
> and tin.
> [Vladimir Mayakovsky "My University"]

The case for the occult in present-day reading may not be overwhelming, even with divination in the guise of predictive tests and attempts to find truth from the dead, as revealed in the recent obsession with Huey and Cattell, but the case for the obscure is undeniable. That most educators view reading acquisiton as an obscure process is evident from the willingness with which they adopt and defend unfounded solutions to reading problems. If one judged the current status of our knowledge of reading acquisition by the amount of agreement found among schools on any instructional practice, then the conclusion would have to be that reading acquisition remains completely enveloped in darkness.

The situation found among researchers is not wholly different. Some attribute reading problems to dialect differences, others to the irregularities of English orthography, and still others to cross-modal integration problems. These are but a few of the postulated sources of reading failure, but they are sufficient to show that after almost a century of research many people hold that the acquisition of literacy is an obscure process at best. This impression, I believe, is wholly false, and leads not only to unconscionable practices in the classrooms but to wasted efforts in research.

Whatever the uncertainties in our knowledge of reading acquisition, there are clearly some results from the last century of research which have a bearing on instruction and on the direction which research should or should not take. However limited these results may be, there is still some merit in sorting out the various trends which are evidenced today in reading research in the hope that such an activity will lead to identification of the major issues in reading acquisition. The purpose of this paper is to suggest areas of research and development which have the greatest potential for furthering the teaching of reading.

Since my ultimate concern is the improvement of reading instruction, I will not discuss research topics which, although important for gaining a basic understanding of reading acquisition, deal with skills which all children appear to acquire without difficulty. I am also ignoring problems related to cultural, language, and dialect differences, and to handicaps. It is important, however, to clarify from the outset that some of my conclusions will be without strong experimental support and some will be outright speculation. Given the paucity of data in some areas of reading, there is little choice in an integrative summary such as this but to select what appears to be the most logical path and assume along with Francis Bacon that "truth will emerge more rapidly from error than from chaos."

II

THE APPLIED RESEARCH TREND

Two major trends in research on reading acquisition have co-existed since at least the turn of the century: the applied and the theoretical. Both are concerned ultimately with improving reading instruction and both claim to originate from experimentally-derived information. But beyond these similarities the two are no more closely related than lightning is to the lightning bug.

The applied trend is concerned with instructional methods. It is behavioristic and often pragmatic; it begins with a proposed solution, and then searches backwards for a justification. In this last characteristic--and in several others--the products of this trend resemble those of religions. New methods are often launched by individuals who possess, at least for some, an irresistable charisma. These persons have become privy to revealed truth in the form of a new teaching method, and proselytize in its name. As their following enlarges, they attempt to anchor the new method in some form of legitimate research just as religions search out previous writings in an attempt to prove that they are the true continuation of the original church. It should be no surprise, therefore, that among those who have been responsible for widely used teaching methods in the past century are a Civil War colonel, a doctor, a public relations specialist, and a printer.

METHODS

The most conspicuous concerns of this trend are the so-called methods of teaching reading: phonics, linguistics, whole word, and the like. There are probably no curricular concerns over which more ink has been unnecessarily spilled or more chaos perpetuated than these. Legions of reading specialists and misled graduate students, egged on by reputable educators, have compared Method A to Method B ad infinitum and ad nauseum. Only a few points need to be emphasized in summarizing the research on these methods. First, no method that I am aware of is sufficiently well defined to be testable. Each is concerned primarily with the earliest stages of reading instruction--often only the first year or less--with nearly total disregard for comprehension. Most decisions which classroom teachers must make on grouping, diagnosis, rate of presentation, use of exemplars, type of learning, reinforcement, review, and the like cannot be made on the basis of the definitions of any of these methods.

Second; most methods regardless of their titles appear to depend heavily on letter-sound learning, the basic difference among them occurring in the timing of such instruction. The phonics/linguistics group tends to start out with heavier doses of letters and sounds than the whole-word group, while the language-experience school is usually vague on this point.

For reasons which may be only partly apparent from the foregoing, I see no useful purpose in further concern, either experimental or observational, with the traditionally defined reading methods. While publishers will continue to extoll the virtures of phonics or whatever method, there is every reason to believe that only a small part of the variance in reading acquisition is attributable to the real effects of such ill-defined practices. Some support has been given to this conclusion by the Cooperative First Grade Reading Study (Bond & Dykstra, 1967). However, more important corroboration can be found in recent studies of the total reading/educational system which will be described shortly.

ORTHOGRAPHY

I have intentionally omitted summarizing research on reformed orthographies such as the Initial Teaching Alphabet (I.T.A.) under methods research because they require a more detailed discussion. Approaches to reading instruction such as I.T.A. (Pitman, 1961) are based on the premise that the major block to successful acquisition of literacy is the irregularity of English orthography. Sir James Pitman, the chief advocate in England of the I.T.A., claims: "Even if taught entirely by look-and-say, the child will nevertheless, at his own time, begin to discern and take advantage of the alphabetic nature of the material, and so extend his reading vocabulary to the full potential. The wonder is that any child should learn by a phonic approach since T.O. [Traditional Orthography] is as unsuitable for phonic as it is for look-and-say [Pitman, 1961, p. 10]." This opinion has also been advanced by a number of distinguished linguists. Bloomfield, for example, held that "the difficulty of our spelling greatly delays elementary education, and wastes even much time of adults. When one sees the admirably consistent orthographies of Spanish, Bohemian, and Finnish, one naturally wishes that a similar system might be adopted for English [Bloomfield, 1933, pp. 500-502]."

Yet there are no experimental or observational data to justify this claim and a considerable amount to negate it. The most often cited evidence in favor of reformed orthography is the supposedly low failure rate in initial reading acquisition in Finland and Japan, countries whose languages have highly consistent letter-sound relationships. Downing (1973), for example, makes this claim and concludes from it that children in English-speaking countries will learn to read faster with a regularized spelling for English. This argument is inconsistent in its logic and factually questionable. In neither Finland nor Japan do we find cultures or educational systems which are in anyway comparable to either England or the United States. In Finland, for example, children enter their first

year of reading instruction at the age of seven, in contrast to six in the United States and five in England. In addition, Finland has an extremely homogeneous population, with over 90 percent of its population speaking the same language and belonging to the same religion. Due to these factors, plus an extensive social welfare system, Finland has no sizable underprivileged groups or disenfranchised minorities--the very groups in the United States which show the highest failure rate in initial reading instruction.

More importantly, there are orthographies which approach the consistency of Finnish and Japanese, such as Spanish and Rumanian, but for which extensive reading failure has been evidenced. If orthographic regularity were a primary determinant of reading success, we would expect a gradation of reading failure among educationally advanced countries, based on characteristics of the orthography in use, but no such gradation has ever been established. As for the claims of successful reading instruction in Finland (Kyostio, 1973) and Japan (Sakamoto & Makita, 1973), there is counterevidence for Finland (Arajarvi et al., 1965) and considerable controversy about a definition of reading in the case of Japan.

There is evidence, however, which tends to negate the reformed-orthography argument. In studies on letter-sound learning which were reported several years ago (Venezky, Chapman, & Calfee, 1972), the degree of regularity in a letter-sound correspondence pattern was not found to be a good predictor of how well that pattern was learned. For example, the long and short vowel patterns (final e versus final consonant) were learned to a considerably higher degree than the initial c patterns,* even though the latter are simpler and more consistent than the former. This finding has been replicated in a more recent study (Venezky & Johnson, 1973), and seems to result from the number of exemplars which are introduced for each pattern.

Finally, it should be noted that the reformed orthography advocates seldom attend to instructional questions beyond the introduction of their proposed alphabets. Would it be acceptable, for example, to introduce I.T.A. in conjunction with a whole word approach?

In summary, there appears to be little support and some counter-evidence for the reformed orthography approach to reading instruction. This is not to say that some teachers won't be successful in using I.T.A. or the Unifon system. There is no reason to doubt the numerous claims of success which have been made for these two systems, or in fact for any method. But as major approaches either to improving reading instruction on a large scale or to gaining a better understanding of how children learn to read, reformed spelling holds little promise.

MANAGEMENT

A third applied research area centers not on the specific teaching method or spelling system used, but on the manner in which the total reading program is managed within a school building.

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*That is, the patterns in which initial c appears before e, i, or y (and is therefore soft), or before any other letter (and is therefore hard).

On one level of concern are the skill management systems, such as the Wisconsin Design for Reading Skill Development (Quilling & Otto, 1971). These systems are based on the specifications of testable subskills which are arranged in either a linear sequence or a hierarchy. The management system defines the skills, specifies assessment procedures for each (usually criterion-referenced tests), and provides record-keeping mechanisms and a resource file which relates skills to instructional components in one or more commercially-available programs. Such management systems can be criticized on a variety of grounds, such as the skills which are selected, the skill sequencing, and the overemphasis on testing. However, they do encourage teachers to attend to individual needs. Research in this area has been limited so far to establishing relationships among subskills, and has yet to show much promise for improving the teaching of reading. What remains to be pursued, however, is the impact of these systems on teacher behavior.

On a different level are attempts to restructure totally the school organization so that individual needs can be better served and teachers can work more efficiently. One such system, called the multi-unit school (which is a component of Individually Guided Education [Klausmeier, in press]), groups classes into units and assigns differential roles to teachers. Typically, kindergarten, first, and second grades form one unit while third, fourth, and fifth grades form another. Each unit has a unit leader plus teachers and aides. The unit leaders within a school direct their unit staffs and also serve as a curricular planning board. For reading instruction, the unit team decides how children will be grouped and what work they will do. What is most encouraging about such schemes is that they stress the total educational system within a school, rather than a single component of it. However, too few evaluative data are available to assess objectively the success of such efforts.

But perhaps more important for reading success than skill management or school organizational model is the total management of the reading program within the school structure. This has been emphasized in two recent studies, both based on subjective analyses of schools which succeeded in teaching reading to disadvantaged students, (Weber, 1971; State of New York, 1974). In the Weber study, the successful schools were characterized by strong, well identified leadership, careful diagnosis of individual abilities, and continuing education for teachers. The 1974 New York study concluded that "the differences in pupils' reading achievement [in the schools studied] were primarily attributable to administrative policies, behavior, procedures and practices [p. 20]." Leadership in instruction in reading (principal, assistant principal, or group of dedicated teachers) was also noted as a significant variable. Even though the methodologies of these studies require careful scrutiny, the results provide compelling motivation for further use of the subjective, case analysis approach.

The process of reading instruction, including staff development, resource allocation, attitudes, and leadership, needs careful scrutiny. Other than studies of student-teacher or student-student interaction (e.g., Flanders, 1970), few accounts are available on how reading instruction is planned for and carried out within a school and classroom. The two studies described above are a step towards the procurement of such information.

Educators have tended for too long to blame the reading instruction when children fail to learn to read, whereas in many--if not most--situations the school system as a whole is at fault. Whatever we may learn about the reading process or about the development of reading ability, overcrowded schools with untrained and disinterested teachers will seldom achieve a high degree of success in teaching reading. The sooner we understand what is crucial to successful instruction, the sooner we can reallocate increasingly limited resources in an optimal way.

III

THE THEORY-BASED RESEARCH TREND

The second trend in studies of reading acquisition could loosely be termed theory-based research. It is pursued more out of concern for general psychological problems than for improving the teaching of reading per se. The earliest experimental studies in this trend, those of Cattell, Erdmann, Dodge, Quantz, and others, were motivated by an interest in the speed of mental events. Reading was a conveniently observable behavior whose component processes appeared amenable to precise measurement. Similarly, in the late 1950's when research on reading was revived by experimental psychologists, the primary areas of study were those of general psychological concern, such as the development of perceptual abilities.

For theory-based studies on reading, the task of identifying productive avenues to pursue is quite difficult. Reading research is extremely broad, encompassing disciplines as diverse as psychology, neurology, ophthalmology, typography, and education. Rather than attempting to be comprehensive, the discussion here is limited to the linguistic and cognitive aspects of the preparation of children for formal reading instruction (often called reading readiness) and the development of basic reading skills at the primary level. These are complementary research concerns which differ considerably in the types of theories which they draw upon and the experimental paradigms which they employ.

PREPARATION FOR READING

Research on the prereading child has concentrated recently on three main areas: (1) understanding of the reading task, (2) language development, and (3) perceptual and cognitive skills.

Understanding of the Reading Task

There can be no doubt that some children enter reading instruction with a well-formed concept of what reading is all about; they recognize many of the letters by name, know a few words by sight, and may attempt to sound out sentences. These children will learn to read under almost any teaching method, even one centered upon the local telephone directory. But many children do not enter the reading situation so well-prepared. More often than not they are unaware of either the purpose or the nature of reading; they do not know that letters represent sounds, and that

these sounds can be blended into words and words into meaningful sentences. Some researchers associate this lack of understanding with reading failure. For example, Reid (1966), who interviewed children during their first year of reading instruction in Scotland, writes that: "...reading, prior to the experience, is a mysterious activity to which they [the children] come with only the vaguest of expectancies. In some cases the children... were not even clear whether one 'read' the pictures or the other 'marks' on the paper [p. 60]."

Similar studies in this country and in Canada have shown that under certain experimental conditions children prior to reading instruction and often even during the first year are not sure of the difference between sounds and words. Whatever the validity of these findings, their relationship to the child's progress in initial reading instruction remains to be established.

Although lack of understanding of the reading task would appear to have a negative effect upon initial reading acquisition, there is no evidence to substantiate this hypothesis. Furthermore, the oral reading errors reported by both Biemiller (1970) and Weber (1970) for beginning readers could be interpreted as evidence against this position. In both of these studies, even the poor readers, when they made substitution errors, did so in a manner that tended to retain a meaningful interpretation of the sentence through the point where the error was made. In the Weber study, for example, almost 90 percent of the substitution errors of both good and poor readers were in this category. Whatever misconceptions these children had about reading, one factor which they had clearly grasped was that the print was to be translated into meaningful utterances. Either the child's reported misunderstanding of the reading task results from the experimental methodology employed and is therefore not relevant to learning to read, or it is so minor a factor that it has no noticeable influence on the child once he or she encounters formal reading instruction. In either case, it is difficult to build a strong case for misunderstanding of the task as a major factor in reading failure.

Language Development

Although children come to the reading task with differing experiences and expectations, almost all can use language to communicate with adults and with peers. Articulation errors, though still occurring at the age of six, particularly for English fricatives, result mostly from slow motor development and are not direct indicators of reading problems. Phonemic discrimination is also well-developed at the first grade level, as adequate testing will reveal, even for those children so cavalierly classed as "verbally deprived." Morphology, syntax, and vocabulary continue to develop beyond this level, yet all three are already sufficiently developed to allow children to express their immediate needs and impressions. Reading problems related to morphology, syntax, and vocabulary may result, however, from the failure of reading texts to reflect accurately the level of development of each of these skills at various ages.

The child's ability to use language for communication presents mostly tactical problems for the teaching of reading--selection of appropriate language forms and designation of which words must be taught orally before instruction begins. But the child's ability to treat language analytically appears to be a far more serious problem, and has been identified as a crucial reading variable in a number of different cultures. At some point in almost all reading programs, sounds are treated as individual units which the child must manipulate, especially in attaching sounds to letters and blending them into words. These tasks are, for reasons still not understood, difficult for many children at the kindergarten and first grade levels. Zhurova (1963) reported that Russian children still have trouble at the age of seven in isolating the initial sound of a word, especially if the sound is a stop. Bruce (1964) tested British children on their ability to remove a medial sound from a word to produce a second word (e.g., eliminating /t/ from stand to give sand) and found that below the age of seven they could not learn the task. Schenk-Danziger (1967) reported similar results in Austria as did Calfee, Chapman, and Venezky (1972) in the United States. Similarly, blending has been found to be difficult for some initial readers (Chall, Roswell, & Blumenthal, 1963).

In all of these studies, however, conclusions were reached on the basis of at most a few brief training/testing sessions, or a single testing session alone. Bruce, for example, presented a total of 30 test items in a single session with only a few warm-up items on which feedback was given. When carefully developed, sustained instruction is provided, most kindergarten level children appear capable of learning to match words according to their initial sounds and to blend sounds to make words (Kamm, 1974). Thus the inabilities may in fact be real, but they do not seem to indicate major deficits in processing capability so much as differences in acoustical experiences.

Perceptual and Cognitive Skills

For the average child the perceptual and cognitive demands of initial reading instruction, other than sound abstraction, are not excessive. At the kindergarten level children can match letters of the alphabet, although left-right reversals for single letters (e.g., confusing lower case b and d) and order reversals for letter strings (e.g., confusing was and saw) are common. These reversals may continue through first and even second grade, but are not by themselves barriers to learning to read, except in extremely rare cases. Most other skills required for learning initial reading--scanning left-to-right, following simple instructions, etc.--appear to be available by the end of kindergarten, even in children from lower socioeconomic environments. Some skill deficits, however, such as those associated with sound manipulation and word identification, appear to be more drastic in children of lower socioeconomic status.

Other Potential Skills

Conspicuously missing from the skills mentioned above are, among others, letter-name knowledge, fine motor performance, and visual discrimination of objects and shapes--all skills that are prominent features of popular readiness programs and are assessed on standardized reading readiness tests (e.g., Metropolitan, Clymer-Barrett). There is strong evidence that training in these skills yields little gain in reading scores. Gates, Bond, and Russell (1939) found that at the primary level the correlation of geometric form perception with reading achievement was significantly lower than the correlation of word perception with reading. Paradis (1974) reported a series of studies in which reading achievement at the primary level was little affected by discrimination training with nonverbal stimuli.

Letter naming is central to the popular conception of reading instruction, but a logical justification for this role has never been made. According to Durrell (1956), letter names are effective mediators for letter sounds--a position rendered indefensible by a curscry glance at the alphabet. Three letters--h, w, y--have names which do not contain their primary sounds and 7 others--a, e, i, o, u, c, g--do not contain the sound which is typically taught first in reading programs. Of the remaining 16, 9 are composed of a consonant-vowel structure while 7 are vowel-consonant (e.g., f, l, m, n). This means that 40 percent of the letter names are not usable as sound mediators and the remaining 60 percent must be differentiated according to where the mediated sound occurs. There are, as most reading teachers know, more effective approaches to teaching letter sounds. It should also be pointed out that there is no evidence that instruction in letter naming improves reading achievement. Both Ohnmacht, (1969) and Johnson (1970) failed to find a significant advantage in letter-name training over other forms of initial training for benefitting first grade reading achievement.

Fine motor training is in the same position as letter naming; it possesses neither a strong logical connection to reading nor experimental justification. On the contrary, attempts to affect initial reading skills through fine motor training have failed both with alphabetic (Pryswansky, 1972) and nonalphabetic materials (Cohen, 1967; Rosen, 1966).

ACQUISITION OF READING SKILLS

In discussing reading acquisition, several interesting areas, including eye movements and reading comprehension, will be omitted in order to concentrate on visual word recognition, which has returned after almost 75 years to the forefront of experimental psychology. Eye movement studies are interesting, but there seems to be little value in improving eye movements rather than in improving the cognitive and perceptual processes which appear to control such movements.

As for comprehension, which is the Outer Mongolia of reading research, deeper knowledge of visual word recognition appears to be a prerequisite for improving comprehension research.

What little is known about the development of visual word recognition derives from about a dozen studies which have been reported over the last 40 years. In the earliest "modern" study on this topic, Hill (1936) established that the main effect of reading instruction was to focus the learner's attention on the beginning of the word. Hill also found (as have a number of studies since) that even in the earliest stages of learning, word configuration is not a salient cue for recognition.

Attempts to isolate the cues which children use in recognition at different stages of learning (Gates & Boeker, 1923; Marchbanks & Levin, 1965; Williams, Blumberg, & Williams, 1970; Leslie, 1975) have generally been restricted to the prereading and early primary reading stages. In general, these studies have supported Hill's findings, especially regarding the saliency of the first letters of a word.

A second and potentially more important line of recent research has been in the development of awareness of orthographic structure. Most but not all of this work derives from E. J. Gibson's studies of recognition of pronounceable and unpronounceable nonsense words, and the general conclusion from several different studies is that at least by the third year of reading instruction, children can demonstrate an awareness of orthographic regularity (Rosinski & Wheeler, 1972; Golinkoff, 1974).

This result is especially important when viewed in relation to two other research trends. One of these trends is represented by word recognition studies which use adult subjects, and especially those studies that attempt to isolate processing stages. Orthographic structure appears to be a major variable in the recognition process, particularly for explaining why a letter can be identified more rapidly in a word than in isolation. (For a summary of recent work in this area, see Massaro, 1975, and Gibson & Levin, 1975.) The picture that is emerging of the word recognition process gives a central role to knowledge of orthographic structure in the earlier stages.

The second trend is represented by developmental studies of visual information processing, but especially those by Haith and his students on the role of short-term visual memory (Haith, 1971). These studies suggested that the basic differences between children and adults in visual information processing lie in the utilization of experience and familiarity for storage, encoding, and visual rehearsal. Children and adults did not differ significantly in threshold recognition times for single stimuli presented at the center of the visual field, nor did five year olds show any decrease in recognition ability for stimuli exposed three degrees off center. When multiple stimuli were presented in a single array, with an indication of the item to respond to appearing at variable times after the offset of the array, children and adults showed the same rate of decrease in accuracy for delays of up to 150 msec. After that point, however, the five year olds did significantly worse than the adults.

What these results suggest for the study of reading acquisition is that basic visual processing capabilities are already developed by the time the child encounters the reading task. But what must develop is an ability to store briefly the stimuli in reading, that is, words and word components, until recognition and integration take place. The most relevant experience which appears to be required for this process, given the lack of saliency of word configuration, is orthographic structure. It seems, therefore, that the most promising line of research to follow now on the acquisition of word recognition ability is the role of orthographic structure in recognition and storage.

It should be pointed out, however, that the concept of orthographic structure is still somewhat vague. The first attempt to relate orthographic structure to word perception (Gibson, Pick, Osser, & Hammond, 1962) concluded that the relevant perceptual units were letter clusters with relatively invariant mappings into sound. However, a replication of this study with deaf subjects (Gibson, Shurcliff & Yonas, 1970) showed that the mapping into sound was not essential for facilitation of word recognition. Thus, the issue was distilled down to constraints on letter strings within words which aid the reader in recognizing or retaining word information. Exactly which characteristics of real words are utilized remains to be explored.

Letter-sound Generalizations

It seems appropriate, given the bias in this paper toward studies on word recognition, to turn to a topic related to orthographic structure, that of the acquisition of letter-sound generalizations. These are important for learning to read alphabetic or syllabic writing systems, although their use does not by itself guarantee competent reading behavior. Besides the roles they may play in the early processing stages of word recognition, they also aid the learner in developing word recognition ability by providing a means for (1) checking the identification of a word previously encountered, but still not known well enough to be identified with high confidence from its components or from context, and (2) generating the pronunciations of words not encountered before in print, but which may be in the reader's listening vocabulary. Perfectly predictable correspondences are not required for either of these functions, since in each situation the reader has other cues to work with; the pronunciation of the printed form must only approximate in most circumstances the actual pronunciation for the appropriate match to be made. For example, in the sentence "The cowboy ran the horse into the street" the word ran may, if not recognized correctly by sight or context, be pronounced /ren/ initially, but if the reader has correctly interpreted "The cowboy" (and speaks English) he will probably recognize that this is not the correct form and try another pronunciation. Observations of children during oral reading show exactly this process at work. Without the ability to approximate sound from spelling, the child would be dependent upon other readers

for substantiating his word identifications and consequently would develop this ability quite slowly.

Reliance on letter-sound generalizations in word recognition appears to decrease as word identification ability increases, and the competent reader probably makes little use of them in normal reading. Nevertheless, the ability to apply letter-sound generalizations continues to develop at least through grade eight (Calfee, Venezky, & Chapman, 1969). Whether this is due to a continual reliance upon sounding out words or is a result of increasingly more efficient memory organization and retrieval is not known. But since the use of letter-sound generalizations appears to depend heavily upon examples stored in memory, organization and retrieval probably account for a significant part of this development.

Acquisition of Specific Patterns

The development of letter-sound generalizations has been studied over the past five years through the analysis of pronunciations of synthetic words constructed to contain specific spelling patterns (Calfee, Venezky, & Chapman, 1969; Venezky, Chapman, & Calfee, 1972; Venezky & Johnson, 1973; Perfetti & Hogaboam, in press). Results from these studies are primarily descriptive, either of age or reading ability differences, or of relationships between decoding ability and other reading abilities (e.g., comprehension). Some of the results, however, are suggestive of how information is processed during decoding, and of the effects of instruction upon this process. The more important of these, drawn from Venezky, Chapman, and Calfee, 1972, are summarized below (see also, Venezky, 1974).

1. Completeness of processing. Good and poor readers at the second grade level differed little in their ability to decode invariant consonants (e.g., b, d, l, m) at the beginning of words. (Both groups scored above 90 percent correct.) However, for the same consonants in medial and final position, the poorer readers showed a dramatic drop in percentage of correct responses while the better readers showed only a slight reduction. The initial position scores for the poorer readers indicate that neither the concept of attaching sounds to specific letters nor the particular letter-sound correspondences involved in the study were major sources of difficulty. What appeared to be troublesome was the processing of information beyond the first letter of a word. One hypothesis is that all of the letters are processed, at least through recognition, but in generating a pronunciation only the sound correspondences for the initial letters are consistently applied. Correspondences for some of the remaining letters might be applied, especially for vowels, but generating a "word" which sounds English might be sufficient to satisfy the poorer reader.

An alternative hypothesis is that some of the letters after the initial ones are not processed properly, that is, they are incorrectly

recognized, but that correspondences are applied for all of the resulting identifications. A forced-choice letter recognition task might provide a test for these hypotheses, but the possibility of a strategy change by the reader for such a task would need to be considered.

2. The role of exemplars. The complexity of a correspondence, computed from the number and type of graphemic, morphemic, and phonological features which need to be considered for proper application, is not a good predictor of how quickly a correspondence is acquired. Single letter vowel spellings in monosyllabic words, for example, are generally long or short, depending (in general) upon whether the word ends with a consonant or with a final e. To generalize this rule, a child must observe not only the letter that follows the vowel but also the letter after that. For initial c, on the other hand, the child need check only the following letter. If it is e, i, or y, the c is soft as in cent, city, and cycle; otherwise it is hard as in clip, coat, crumb, and cute.

The initial c patterns have only one exception among the words which grade schoolers might see, viz., cello, and this word is rare in the primary grades. The long-short patterns, on the other hand, have numerous common exceptions (e.g., cold, axe, pint, won, wash, one), yet the percentage of correct responses to the long-short patterns at the fourth grade level was more than twice that of c before e, i, or y (86 percent versus 41 percent).

Both the long-short distinction and the c before e, i, or y pattern are taught in one way or another in most reading programs prior to the fourth grade, but one important difference can be noted from an inspection of the vocabularies which reading programs emphasize. Words for both long and short patterns are numerous, and are often minimally contrastive, (e.g., mat-mate, rip-ripe). Words with c before e, i, or y, on the other hand, are rare before fourth grade, and represent probably less than 10 percent of all the initial c words introduced. What constitutes a sufficient number of exemplars to induce a generalization has not been explored extensively for any language pattern, yet clearly it should be a major concern for instruction.

2. Failure to generalize. As the child encounters more and more exemplars for soft initial c, he begins to acquire the appropriate response for this pattern; however, the percentage correct for both eighth graders and college students did not exceed 70 percent. The responses to a related pattern, that of g before e, i, or y, also demonstrated an exemplar affect, but here the effect was one of complete non-generalization. For stimulus words in which initial g, should, in theory, be soft (that is, g before e or i in the present study), fewer than 25 percent of the responses at any grade level (2, 4, 6, and 8) were correct, almost all of the incorrect responses being hard g (/g/).

What appears to be responsible for this lack of generalization are both the number of high frequency words which are exceptions to the so-called rule (e.g., get, geese, gear, gift, girl, and give), and the lack of sufficient rule-observing exemplars. (Among the high-frequency words used in initial reading, only gem, general, germ, giant, and ginger have a soft initial g.) Encountering other rule-observing words in reading

beyond the primary or elementary levels does not seem to have much effect on the generalization of this pattern, since only 25 percent of the college student responses for g before e and i were correct. There may be a critical stage for the formation of letter-sound correspondences; or, equally plausible, perhaps only the more frequent English words have an effect upon generalization processes. These and many other questions remain to be resolved empirically.

Summary

The research on letter-sound learning to date has concentrated on establishing developmental norms for particular letter-sound patterns. This has important applications for reading instruction, but leaves unanswered the question of what processing mechanisms are utilized in developing such generalizations and how they relate to knowledge of orthographic structure. As mentioned earlier, work with deaf subjects indicates that orthographic structure is not necessarily dependent on letter-sound generalizations (Gibson, Shurcliff, & Yonas, 1970); however, the relationship between these two areas remains to be explored for normal-hearing subjects. Since almost all approaches to reading instruction employ overt teaching of letter-sound correspondences, a thorough understanding of their acquisition and utilization merits a high priority in developmental research.

IV

CONCLUSIONS

What I conclude from this review is that reading acquisition is neither occult nor obscure. For instructional research, organizational and management variables such as leadership, teacher training, and diagnosis appear to be more important determinants of reading success than do specific instructional methods, and should therefore be the focus of instructional research. From what has been learned since the earliest studies on reading, I can find no justification for a continued research emphasis on the so-called methods of reading instruction or on modified alphabets. There is clearly a need for good reading programs, and these remarks should not be interpreted as opposition to their development and dissemination, although most of what has appeared in the last five years from commercial publishers has been minor perturbations around well-worn themes.

However, as individualized instruction becomes more widespread, the total set of processes which go on within a school in relation to reading becomes increasingly important. With the breakdown of the teacher-centered, self-contained classroom, cooperation and training of staff, and management of large numbers of students engaged in diverse reading activities become essential, and it is on these processes that instructional research is especially needed.

For research aimed at a basic understanding of how reading is acquired, certain directions are strongly justifiable; the most important of these is research on orthographic regularity, including the relationship of orthographic regularity to letter-sound generalizations. Many questions remain unanswered about prerequisites to learning to read, about eye movements, and obviously about comprehension, but given the current directions of experimental psychology and the present needs of instruction, the most fundamental gap in our understanding of how reading is acquired is in the development of word recognition ability. Within the current state of understanding of visual information processing, the role of orthographic structure appears to be the most crucial factor that needs to be resolved. An extreme hypothesis which might be advanced is that the most important change which the child undergoes in learning to read, and perhaps the only major change which is unique to reading, is in his knowledge of orthographic structure.

This structure is possibly the basis for rapid letter and word recognition and thus essential for allowing processing capacity for semantic integration. This latter ability develops from listening

experiences prior to reading instruction but must be related to the internal form of words derived from visual input for reading to take place.

Rather than exploring this particular hypothesis any further, I wish only to use it to demonstrate the potential importance of one set of reading skills. The importance of these conclusions rests not in the particular topics themselves, but the assumption that enough is known about reading acquisition to select certain topics as highly important for advancing our ability to instruct and to reject others as marginal or distractive. Wide agreement on the selection is not anticipated, but I will be satisfied if the opposition to these conclusions is based upon both a thorough and comprehensive review of the research findings and the assumption that, even considering the gaps in our knowledge about reading acquisition, the subject is far from mysterious.

REFERENCES

Arajarvi, T. et al. The role of specific reading and writing difficulties in various school problems. Annales Paediatriae Fenniae, 1965, 11, 138-147.

Biemiller, A. The development of the use of graphic and contextual information as children learn to read. Reading Research Quarterly, 1970, 6, 75-96.

Bloomfield, L. Language. New York: Holt, Rinehart and Winston, 1933.

Bond, G. L., & Dykstra, R. The cooperative research program in first-grade reading instruction. Reading Research Quarterly, 1967, 2, 5-142.

Bruce, D. J. The analysis of word sounds by young children. British Journal of Educational Psychology, 1964, 31, 158-169.

Burroughs, E. R. Tarzan of the apes. New York: Ballantine Books, 1963, p. 50. (First published in 1912.)

Calfee, R., Chapman, R., & Venezky, R. How a child needs to think to learn to read. In L. Gregg (Ed.), Cognition in learning and memory. New York: John Wilev & Sons. 1972.

Calfee, R., Venezky, R., & Chapman, R. Pronunciation of synthetic words with predictable and unpredictable letter-sound correspondences. Technical Report No. 71. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1969.

Chall, J. S., Roswell, F. G., & Blumenthal, S. H. Auditory blending ability: A factor in success in beginning reading. Reading Teacher, 1963, 17, 113-118.

Cohen, R. Remedial training of first grade children with visual perceptual retardation. Educational Horizons, 1967, 45, 60-63.

Downing, J. Comparative Reading. New York: The Macmillan Co., 1973.

Durrell, D. D. Improving reading instruction. New York: World Book Co., 1956.

Flanders, N. A. Analyzing classroom interactions. New York: Addison-Wesley, 1970.

Gates, A. I., & Boeker, E. A study of initial stages in reading by pre-school children. Teachers College Record, 1923, 24, 469-488.

Gates, A. I., Bond, G. L., & Russell, D. H. Methods of determining reading readiness. New York: Teachers College, Columbia University, 1939.

Gibson, E. J., & Levin, H. The psychology of reading. Cambridge, Mass.: MIT Press, 1975.

Gibson, E. J., Pick, A., Osser, H., & Hammond, M. Role of grapheme-phoneme correspondence in perception of words. American Journal of Psychology, 1962, 75, 554-570.

Gibson, E. J., Shurcliff, A., & Yonas, A. Utilization of spelling patterns by deaf and hearing subjects. In H. Levin and J. P. Williams (Eds.), Basic studies on reading. New York: Basic Books, 1970.

Golinkoff, R. M. Children's discrimination of English spelling patterns with redundant auditory information. Paper presented at a meeting of the American Educational Research Association, Chicago, 1974.

Haith, M. M. Developmental changes in visual information processing and short-term visual memory. Human Development, 1971, 14, 249-261.

Hill, M. B. A study of the process of word discrimination in individuals beginning to read. Journal of Educational Research, 1936, 29, 487-500.

Johnson, D. Factors related to the pronunciation of vowel clusters. Technical Report No. 149. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1970.

Kamm, M. et al. The 1971-72 field test of the Prereading Skills Program. Technical Report No. 269. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1974.

Klausmeier, H. IGE: An alternate form of schooling. In H. Talmage (Ed.), Systems of individualized education. Berkeley, Cal.: McCutchan Publishing Co., in press.

Kyostio, O. K. Finland. In J. Downing (Ed.), Comparative reading. New York: The Macmillan Co., 1973.

Leslie, R. Position saliency in children's short-term recognition memory for graphic patterns. Technical Report No. 351. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1975.

Marchbanks, G., & Levin, H. Cues by which children recognize words. Journal of Educational Psychology, 1965, 56, 57-61.

Massaro, D. (Ed.) Understanding language: An information processing analysis of speech perception, reading, and psycholinguistics. New York: Academic Press, 1975.

Ohnmacht, D. C. The effects of letter knowledge on achievement in reading in the first grade. Paper presented at the meeting of the American Educational Research Association, Los Angeles, February 7, 1969.

Paradis, E. E. The appropriateness of visual discrimination exercises in reading readiness materials. Journal of Educational Research, 1974, 67, 276-278.

Perfetti, C. A., & Hogaboam, T. The relationship between single word decoding and reading comprehension skill. Journal of Educational Psychology, in press.

Pitman, J. Learning to read. Reprinted from the Journal of the Royal Society of Arts, February, 1961.

Pryzwansky, W. B. Effects of perceptual-motor training and manuscript writing on reading readiness skills in kindergarten. Journal of Educational Psychology, 1972, 63, 110-115.

Quilling, M. R., & Otto, W. Evaluation of an objective-based curriculum in reading. Journal of Educational Psychology, 1971, 65, 15-18.

Reid, J. F. Learning to think about reading. Educational Research, 1966, 9, 56-62.

Rosen, C. An experimental study of visual perceptual training and reading achievement in first grade. Perceptual and Motor Skills, 1966, 22, 979-986.

Rosinski, R. R., & Wheeler, K. E. Children's use of orthographic structure in word recognition. Psychonomic Science, 1972, 26, 97-98.

Sakamoto, T., & Makita, K. Japan. In J. Downing (Ed.), Comparative reading. New York: The Macmillan Co., 1973.

Schenk-Danzinger, L. Probleme der Legasthenie. Schweizerische Zeitschrift für Psychologie, 1967, 20, 29-48.

State of New York, Office of Education Performance Review, School factors influencing reading achievement; a case study of two inner city schools. Albany, New York, 1974.

Venezky, R. L. Theoretical and experimental bases for teaching reading. In T. A. Sebeok (Ed.), Current Trends in Linguistics. Vol. 12. The Hague: Mouton, 1974. Pp. 2058-2100.

Venezky, R. L., Chapman, R. S., & Calfee, R. C. The development of letter-sound generalizations from second through sixth grade. Technical Report No. 231. Madison: Wisconsin Research and Development Center for Cognitive Learning, 1972.

Venezky, R. L., & Johnson, D. Development of two letter-sound patterns in grades one through three. Journal of Educational Psychology, 1973, 64, 109-115.

Weber, G. Inner-city children can be taught to read: Four successful schools. Occasional Paper No. 18, Washington, D. C.: Council for Basic Education, 1971.

Weber, R. M. First graders use of grammatical context in reading. In H. Levin and J. Williams (Eds.), Basic studies on reading. New York: Harper and Row, 1970.

Williams, J. P., Blumberg, E. L., & Williams, D. V. Cues used in visual word recognition. Journal of Educational Psychology, 1970, 61, 310-315.

Zhurova, L. E. The development of analysis of words into sounds by preschool children. Soviet Psychology and Psychiatry, 1963, 2, 17-27 (published originally in Russian in Voprosy psikhology, No. 3, 1963).